Siting rural development–

to protect lakes and streams and decrease road costs

Center *for* Land Use Education

The first two articles in this series discussed how impervious surfaces such as roads and rooftops increase stormwater and pollutant runoff and decrease water quality and wildlife habitat, and then provided a list of actions to minimize those impacts. This article explores how to site rural development and its associated impervious surfaces in a way that will achieve the goals of protecting lakes and streams AND decreasing costs for roads.

Rural areas by definition have more undeveloped space than urban areas. Consequently, planners, developers and local officials have more choices when they are deciding where to locate new development.

Water highways to roadways
Historically, people located their homes and businesses near lakes and streams for a number of practical reasons including transportation of people, furs, logs and other products; drinking water for people and animals; power for mills and industry; fishing; and recreation. As times have changed so have the requirements for homes and businesses to be located near lakes and streams. For instance, logs are now hauled by truck or rail, water is delivered to cows in free stall barns, and businesses are generally powered by coal or gas-fired power plants.

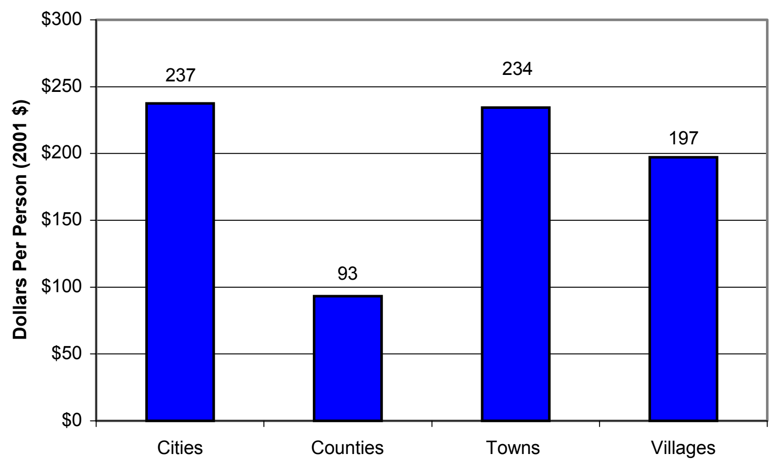
Public costs of transportation
Transportation has also seen large changes in Wisconsin from the days when river corridors were the main transportation routes to today with 112,362 miles of highways, roads, and streets in the state, all impervious surfaces. These roads are necessary for many people to travel to work, school, or recreational areas. In 2000, vehicles traveled 57 billion miles in Wisconsin, which works out to 10,261 vehicle miles per person; 105% of the national average.

Roads and transportation constitute a significant portion of municipal spending. As a percentage of total expenditures in 1999, this spending in Wisconsin amounted to:

- 41% for towns,
- 18% for villages,
- 16% for cities, and
- 9% for counties.

Figure 1 illustrates the dollars spent for roads and transportation per person in Wisconsin. Based on this information, governments in our state pay an average of $316 per person annually for roads and transportation *(Average expenditures per person = average expenditure per person for city, town and county + average expenditure per person for county).*
An example will be presented later in this article that decreases road costs and protects lakes and streams.

Figure 1. Roads & transportation expenditures per person in Wisconsin—1999

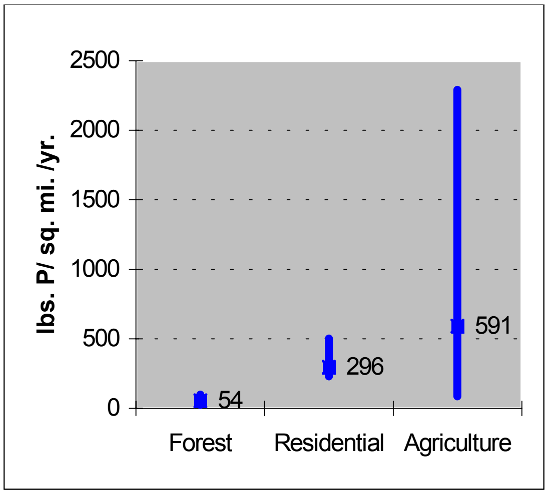


Sources: DOR, UW, UWEX

Natural resource costs of transportation
The path water takes from the time it hits the ground to when it enters a lake or stream determines what pollutants are transported to the waterway. For instance, if water runs across a road it may carry oil or antifreeze and if it seeps through the ground near a septic field it will carry nutrients such as nitrogen and phosphorus.

In more than 80% of Wisconsin's lakes, phosphorus is the key nutrient. Adding more phosphorus causes more algae and weed growth. The same is generally true in streams, although shading, flow and other factors also play important roles in plant growth. Research based on 35 watersheds, mostly in southern Wisconsin, found that the amount of phosphorus carried from the land into lakes and streams varies widely depending on land uses as shown in Figure 2. The most phosphorus per area was delivered to lakes from agricultural lands and the least from forested

Figure 2. Phosphorus (P) loading from land uses



Source: Panuska and Lillie, 1995
Numbers are median values.
Lines illustrate range.

lands, with residential lands falling in the middle. This trend suggests that phosphorus loading increases with increasing nutrient applications and land disturbance – a logical finding since phosphorus is often bound to soil particles that are washed into waterways upon land disturbance. Ditches, storm sewers and other direct pathways for water can transport soils and nutrients long distances to a waterbody.

Lakes and streams are fed by groundwater plus rain and snowmelt that run off the land in the watershed. Figure 3 shows that groundwater supplies a large portion of water for seepage lakes. To learn more about the relationship between residential development and groundwater, see the new fact sheet 'Residential Development and Groundwater Resources'.

Strategies to reduce impervious surface impacts on lakes & streams

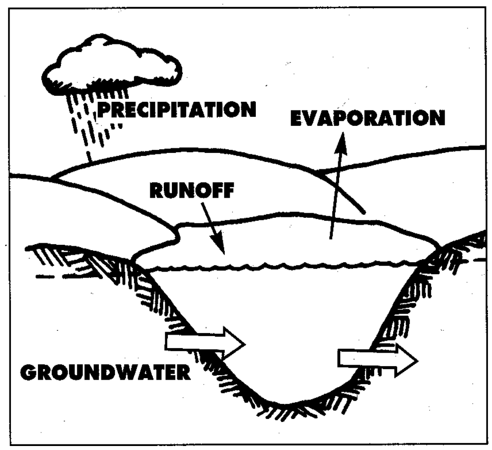
Three ways to minimize the negative effects of impervious surfaces are to:

- Locate impervious surfaces farther from waterways & sensitive areas
- Minimize the amount of impervious surfaces
- Filter and absorb runoff from impervious surfaces

These approaches are most effective when applied on a watershed scale and on a site design scale.

Next comes an example of rural development that decreases road costs AND protects water quality.

Figure 3. Seepage Lake



Source: Shaw, Mechenich, Klessig, 1996

Planning pays off

The design of a rural subdivision can do much more to reduce runoff and nutrient loads than best management practices (BMPs; in this case stormwater sewers and a sediment pond), as shown in Table 1. Utilizing BMPs reduced nutrient loading by less than 5% in this study, whereas switching from a conventional subdivision design to an open space subdivision decreased nutrient loading by 40-50% by locating impervious surfaces farther from waterways and minimizing the amount of impervious surfaces.

Tools to protect lakes and streams

In addition to open space subdivisions, other useful tools for protecting the water quality in lakes and streams include:

- Incentive programs – to protect or restore

Table 1. Nutrient Loads

	Conventional Subdivision	Conventional Subdivision + BMPs	Open Space Subdivision
Phosphorus (lbs./yr.)	46	44	23
Nitrogen (lbs./yr.)	274	264	156

Source: Center for Watershed Protection, 1998

In the open space subdivision significant cost savings were achieved by reducing impervious surfaces by 20% by:

- reducing road widths,
- reducing driveway lengths & widths, and
- using a road loop rather than a cul-de-sac.

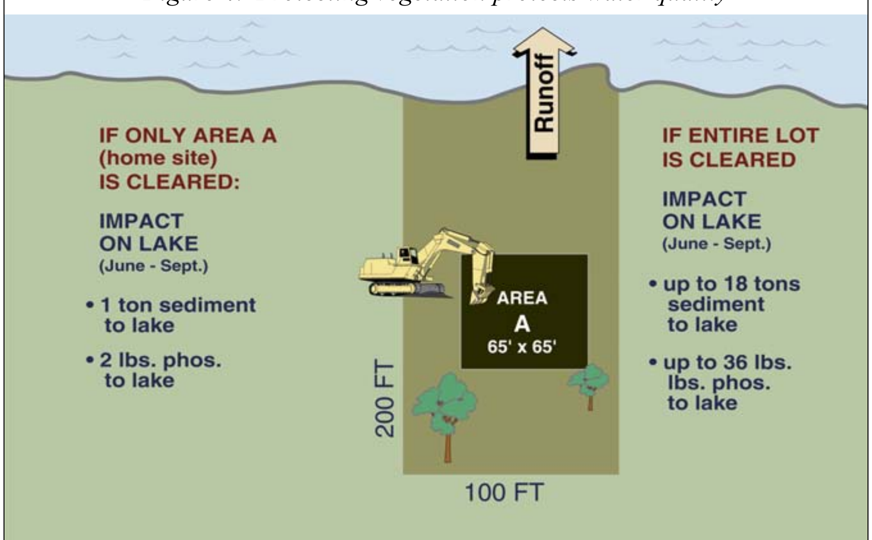
shoreline buffers, to allow greater development density in open space design, etc.
- Technical assistance – to design open space subdivisions and buffer areas, calculate fertilizer needs, develop markets for water quality friendly crops, etc.
- Conservation easements – to protect sensitive areas like wetlands, high quality habitat areas, bluffs and steep slopes.
- Impact fees – for treatment of stormwater runoff, creating wetlands when natural wetlands are filled, etc.
- Regulations – to limit land uses and intensities in sensitive areas, limit impervious surfaces, require erosion control and stormwater plans, provide setbacks from shorelines and wetlands, etc.
- Educational programs – to identify sensitive areas, promote open space design and best management practices, explain effects of impervious surfaces, etc.

Using these tools during community planning throughout the watershed and during the design of development sites can help achieve the following water protection objectives.

Minimize pollutant sources

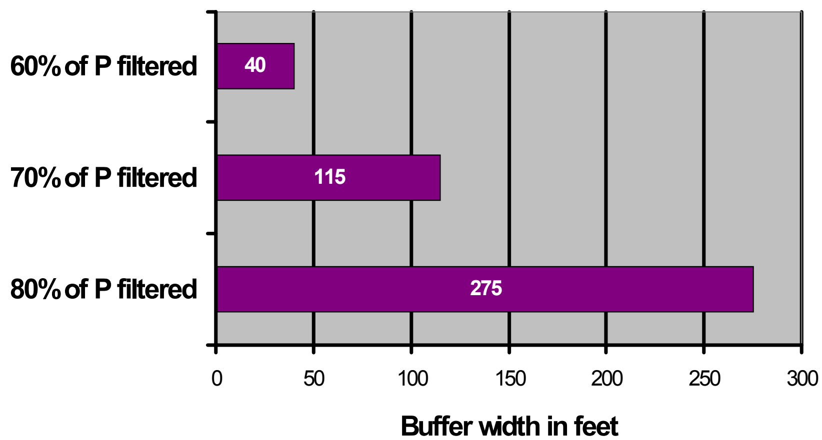
- ♦ Encourage land uses that deliver less phosphorus and other pollutants like forested lands, and discourage expansion of land uses that deliver more pollutants.
- ♦ Maintain native, long-lived, soil-stabilizing vegetation wherever possible to limit erosion. See Figure 4.
- ♦ Minimize the amount of land disturbing activity by following natural land contours when planning for roads and buildings.
- ♦ Locate development with groundwater pollutant inputs like septic tanks or fertilizers on soils that can effectively treat pollutants. On sandy soils locate the development where groundwater is flowing away from nearby lakes and streams.

Figure 4. Protecting vegetation protects water quality



Source: DNR memo from Panuska, 1994, Graphic by Wisconsin Lakes Partnership

Figure 5. Larger buffers filter more phosphorus

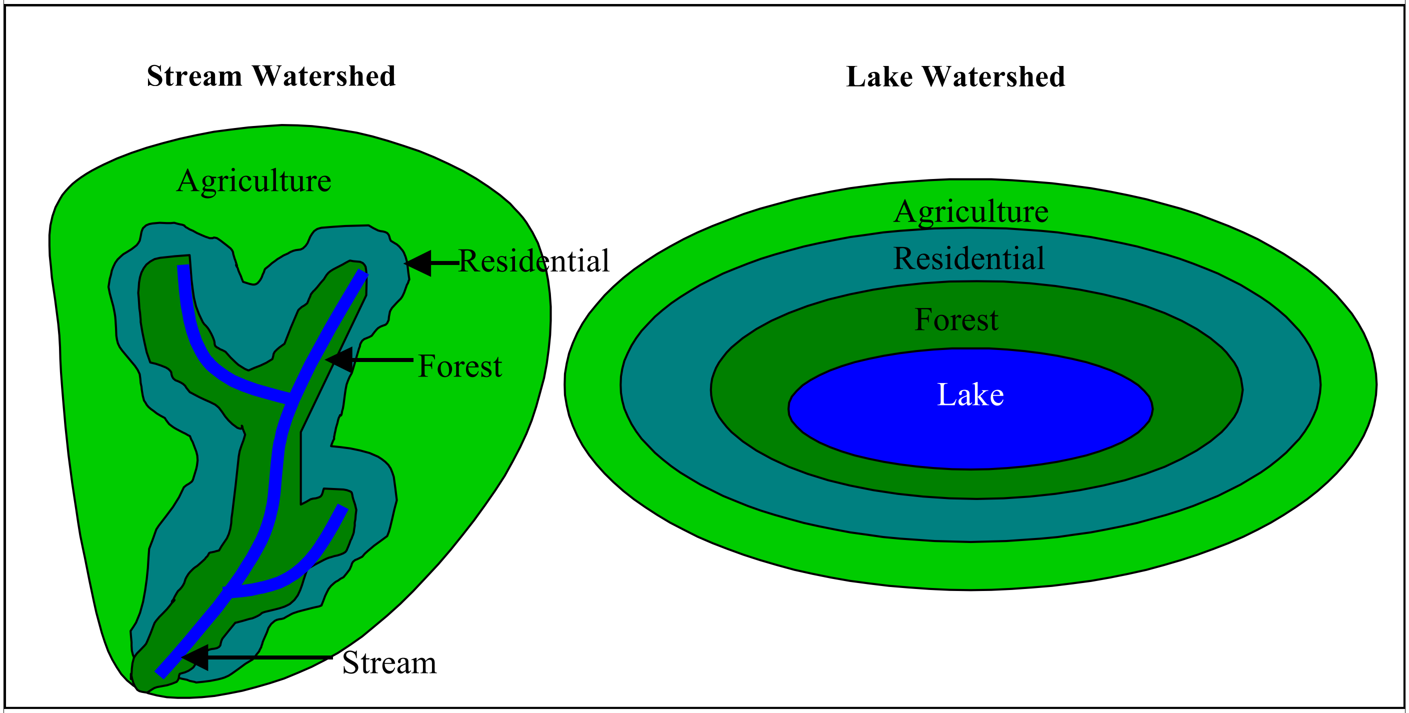


Source: Desbonnet, 1995.

Minimize pollutant delivery

- ♦ Protect and restore large, natural shoreline buffers along waterways to filter pollutants from runoff. See Figure 5.
- ♦ Protect and create infiltration areas to minimize runoff.
- ♦ Minimize the extent and connection of impervious surfaces and compacted areas to the water by:
  - ◊ Locating new development adjacent to existing developed areas to minimize road expansion.
  - ◊ Constructing multiple story buildings to minimize building footprint.
  - ◊ Decreasing road and driveway widths and lengths.
  - ◊ Increasing building setbacks from the water.
  - ◊ Using shared driveways and parking areas.
- ♦ Minimize soil compaction by:
  - ◊ Limiting heavy equipment to specified areas.
  - ◊ Incorporating compost in soils to reverse compaction
- ♦ Encourage land uses like forested lands, which deliver less phosphorus close to waterways, and land uses that deliver more phosphorus or other pollutants farther from waterways. See Figure 6 on next page.

Figure 6. Land use patterns to decrease phosphorus loading to waters.



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